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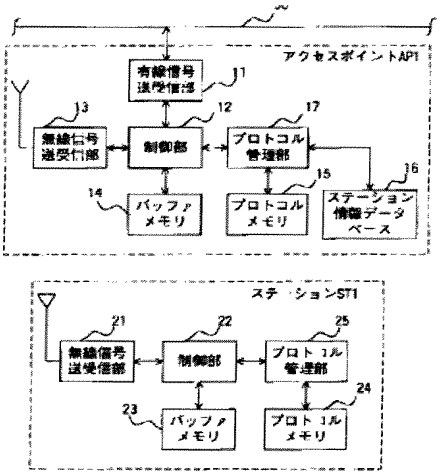
Continued on last page

(54) [Title] Multiprotocol compatible communication control method, multiprotocol compatible communication system, and recording medium on which is recorded a multiprotocol compatible communication control processing program

(57) Abstract

[Problem] To enable communication which accommodates protocol differences when wireless communication occurs between an access point and a station for a wireless LAN system.

[Means to solve] An access point AP1 and a station ST1 that enables wireless communication with this access point are provided; access point AP1 holds protocol information that has been set as a default in a protocol memory 15, and when wireless communication with station ST1 occurs, a protocol management unit 17, in response to an instruction from a control unit 12, determines whether the protocol of station ST1 is supported by this access point. If it is not supported, the protocol set as the default is provided to station ST1, and at station ST1 a protocol management unit 25 saves the provided protocol in a protocol memory 24 in response to an instruction from a control unit 22, and communication with access point AP1 occurs using the saved protocol.



Key:
- 11 Wired signal transmitting/receiving unit
- 12 Control unit
- 13 Wireless signal transmitting/receiving unit
- 14 Buffer memory
- 15 Protocol memory
- 16 Station information database

17	Protocol management unit
21	Wireless signal transmitting/receiving unit
22	Control unit
23	Buffer memory
24	Protocol memory
25	Protocol management unit
AP1	Access point
ST1	Station

Claims

1. A multiprotocol-compatible communication control method characterized in that it has at least one access point and at least one station capable of accessing this access point by means of wireless communication; said access point has protocol information that has been set as a default; when communication with said station occurs, it is determined whether the protocol information for said station is supported by its access point; and when the protocol information is not supported, the protocol information that has been set as the default is provided to said station, and said station uses the provided protocol information to communicate with said access point.

2. The multiprotocol-compatible communication control method recorded in Claim 1, characterized in that said access point is connected to a wired communication transmission line and has a function whereby it bridges said wired communication transmission line and said station.

3. The multiprotocol-compatible communication control method recorded in Claim 2, characterized in that when said access point receives wired data from said wired communication transmission line and when the destination of that wired data is a given station, that access point determines whether said stations is under its management, and when it is determined that said station is under its management, the protocol information for that station is set with respect to said wired data that has been received, and is transmitted to said station.

4. The multiprotocol-compatible communication control method recorded in Claim 2, characterized in that when said access point receives wireless data and the destination of that wireless data is a given station, that access point determines whether said stations is under its management, and when said station is under its management, the protocol information for that station is set with respect to said wireless data that has been received, and is transmitted to said station.

5. The multiprotocol-compatible communication control method recorded in Claim 2, characterized in that when said access point receives wireless data, and the destination of that

wireless data is its own access point and said wireless data is connection request data, it determines whether the protocol information set in that connection request data is protocol information that is supported by its access point; when the protocol information is supported, communication is established on the basis thereof and communication operations are performed; when the protocol information is not supported, the protocol information set as the default for that access point is set in the connection reply data and sent back to said station, the station receiving it saves the protocol information provided from said access point, and subsequently when it communicates with said access point it communicates using this saved protocol information.

6. A multiprotocol-compatible communication system characterized in that it has at least one access point and at least one station capable of accessing this access point by means of wireless communication;

said access point has a control unit, a protocol information management unit that manages protocol information, a recording means that holds protocol information, and a database that holds information pertaining to said station;

said station has a control unit, a protocol management unit that manages protocol information, and a recording means that holds protocol information;

said access point holds protocol information that has been set as a default in its aforementioned recording means, and when communication with said station occurs, its protocol management unit determines, in response to an instruction from its aforementioned control unit, whether the protocol information for said station is supported by its access point, and when the protocol information is not supported, it reads said protocol information that has been set as the default from its aforementioned recording means and provides that to said station;

and in response to its control unit, the protocol management unit of said station saves in its recording means said protocol information provided by the access point and communicates with said access point using the protocol information saved in this recording means.

7. The multiprotocol-compatible communication system recorded in Claim 6, characterized in that said access point is connected to a wired communication transmission line and has a function whereby it bridges said wired communication transmission line and said station.

8. The multiprotocol-compatible communication system recorded in Claim 7, characterized in that when said access point receives wired data from said wired communication transmission line and when the destination of that wired data is a given station, that access point determines whether said stations is under its management, and when said station is under its management, the protocol information for that station is set with respect to said wired data that has been received, and is transmitted to said station.

9. The multiprotocol-compatible communication system recorded in Claim 7, characterized in that when said access point receives wireless data and the destination of that wireless data is a given station, that access point determines whether said stations is under its management, and when said station is under its management the protocol information for that station is set with respect to said wireless data that has been received, and is transmitted to said station.

10. The multiprotocol-compatible communication system recorded in Claim 7, characterized in that when said access point receives wireless data and the destination of that wireless data is its own access point and said wireless data is connection request data, it determines whether the protocol information set in that connection request data is supported by its access point; when the protocol information is supported, communication is established on the basis thereof and communication operations are performed; when the protocol information is not supported, the protocol information set as the default for that access point is set in the connection reply data and sent back to said station, the station receiving it saves the protocol information provided from said access point, and subsequently when it communicates with said access point, it communicates using this saved protocol information.

11. A recording medium on which is recorded a multiprotocol-compatible communication control processing program having at least one access point and at least one station capable of accessing this access point by means of wireless communication, wherein said access point has protocol information that has been set as a default, and when communication with said station occurs it is determined whether the protocol information for said station is supported by its access point, and when the protocol information is not supported, the protocol information that has been set as the default is provided to said station, and said station uses the provided protocol information to communicate with said access point,

characterized in that said processing program includes: a procedure whereby said access point determines whether the protocol information for said station is protocol information supported by its access point, and a procedure whereby, when it is determined that said protocol information is not supported by its access point, said protocol information that has been set as the default is provided to said station;

and a procedure whereby said station saves said protocol information provided by said access point, and a procedure whereby data transmitted to said access point is created using the protocol information thus saved.

12. The recording medium on which is recorded a multiprotocol-compatible communication control processing program recorded in Claim 11, characterized in that said access point is connected to a wired communication transmission line and has a function whereby it bridges said wired communication transmission line and said station.

13. The recording medium on which is recorded a multiprotocol-compatible communication control processing program recorded in Claim 12, characterized in that when said access point receives wired data from said wired communication transmission line and the destination of that wired data is a given station, that access point determines whether said stations is under its management, and when said station is under its management, the protocol information for that station is set with respect to said wired data that has been received, and is transmitted to said station.

14. The recording medium on which is recorded a multiprotocol-compatible communication control processing program recorded in Claim 12, characterized in that when said access point receives wireless data and the destination of that wireless data is a given station, that access point determines whether said stations is under its management, and when said station is under its management, the protocol information for that station is set with respect to said wireless data that has been received, and is transmitted to said station.

15. The recording medium on which is recorded a multiprotocol-compatible communication control processing program recorded in Claim 12, characterized in that that when said access point receives wireless data and the destination of that wireless data is its own access point and said wireless data is connection request data, it determines whether the protocol information set in that connection request data is supported by its access point; when the protocol information is supported, communication is established on the basis thereof and communication operations are performed; when the protocol information is not supported, the protocol information set as the default for that access point is set in the connection reply data and sent back to said station, the station receiving it saves the protocol information provided from said access point, and subsequently when it communicates with said access point, it communicates using this saved protocol information.

Detailed explanation of the invention

[0001]

Technical field of the invention

With respect to a communication system having an access point connected to a wired LAN as a wired communication transmission line and a station capable of wireless communication with this access point, the present invention pertains to a multiprotocol-compatible communication control method, a multiprotocol-compatible communication system, and a recording medium on which is recorded a multiprotocol-compatible communication control processing program that can accommodate the differences between required protocols when communication occurs.

[0002]

Prior art

Conventionally, the LAN (Local Area Network) has been disseminated as a means of communication between information processing machines. The conventional LAN typically is wired, but there are limitations with respect to this wired LAN based on the location where the information processing machine is installed, or the relocation of the same, so there are various problems such as the complexity of the cabling.

[0003]

Furthermore, when a network is constructed using these types of machines, recently there has been a demand that the network be wireless, and recently there has been much technical development related to wireless LANs.

[0004]

An example of a communication system is shown in Figure 1. The communication system in Figure 1 has several access points AP1, AP2, . . . connected to a wired LAN1, and several stations ST1, ST2, . . . that are capable of wireless communication with any of these several access points AP1, AP2.

[0005]

Problem to be solved by the invention

When communication occurs with a system such as that shown in Figure 1, the access point, which also serves to bridge the wired LAN and the wireless LAN, conventionally executes a protocol conversion corresponding to the various LANs. For example, when a frame is sent from a wireless LAN to a wired LAN, it is converted (the frame's format is changed) to the protocol supported by the wired LAN and then transmitted; conversely, when a frame is sent from a wired LAN to a wireless LAN, it is converted (the frame's format is changed) to the protocol supported by the wireless LAN and then transmitted.

[0006]

This type of protocol conversion method requires protocol conversion devices for only [sic; each of] the supported protocol types, so the size of the communication terminal increases, which leads to a cost increase. Furthermore, in the case of an unknown protocol, a new protocol conversion device compatible with that protocol must be added.

[0007]

Accordingly, the objective of the present invention is to provide a multiprotocol-compatible communication control method, a multiprotocol-compatible communication system, and a recording medium on which is recorded a multiprotocol-compatible communication control processing program which enable communication that accommodates different protocols and which are particularly suitable for a communication system having an access point connected to a wired LAN as a wired communication transmission line and a station capable of wireless communication with this access point.

[0008]

Means to solve the problem

To achieve said objective, the multiprotocol-compatible communication control method of the present invention has at least one access point and at least one station capable of accessing this access point by means of wireless communication, and said access point has protocol information that has been set as a default; when communication with said station occurs, it is determined whether the protocol information for said station is supported by its access point, and when the protocol information is not supported, the protocol information that has been set as the default is provided to said station, and said station uses the provided protocol information to communicate with said access point.

[0009]

Furthermore, the multiprotocol-compatible communication system of the present invention has at least one access point and at least one station capable of accessing this access point by means of wireless communication; said access point has a control unit, a protocol information management unit that manages protocol information, a recording means that holds protocol information, and a database that holds information pertaining to said station; said station has a control unit, a protocol management unit that manages protocol information, and a recording means that holds protocol information; said access point holds protocol information that has been set as a default in its aforementioned recording means, and when communication with said station occurs, its protocol management unit determines, in response to an instruction from its aforementioned control unit, whether the protocol information for said station is supported by its access point, and when the protocol information is not supported, it reads said protocol information that has been set as the default from its aforementioned recording means and provides that to said station; and in response to its control unit the protocol management unit, of said station saves in its recording means said protocol information provided by the access

point and communicates with said access point using the protocol information saved in this recording means.

[0010]

Furthermore, a recording medium on which is recorded a multiprotocol-compatible communication control processing program having at least one access point and at least one station capable of accessing this access point by means of wireless communication, wherein said access point has protocol information that has been set as a default, and when communication with said station occurs it is determined whether the protocol information for said station is supported by its access point, and when the protocol information is not supported, the protocol information that has been set as the default is provided to said station, and said station uses the provided protocol information to communicate with said access point, the recording medium on which is recorded a multiprotocol-compatible communication control processing program of the present invention is one for which said processing program includes: a procedure whereby said access point determines whether the protocol information for said station is protocol information supported by its access point, and a procedure whereby, when it is determined that said protocol information is not supported by its access point, said protocol information that has been set as the default is provided to said station; and a procedure whereby said station saves said protocol information provided by said access point, and a procedure whereby data transmitted to said access point is created using the protocol information thus saved.

[0011]

For each of these inventions, said access point is connected to a wired communication transmission line and has a function whereby it bridges said wired communication transmission line and said station.

[0012]

Thus, said access point is connected to a wired communication transmission line and has a function whereby it bridges said wired communication transmission line and said station, and when said access point receives wired data from said wired communication transmission line and the destination of that wired data is a given station, that access point determines whether said stations is under its management, and when it is determined that said station is under its management, the protocol information for that station is set with respect to said wired data that has been received, and is transmitted to said station.

[0013]

Furthermore, said access point is connected to a wired communication transmission line and has a function whereby it bridges said wired communication transmission line and said station, and when said access point receives wireless data and the destination of that wireless data is a given station, that access point determines whether said stations is under its management, and when said station is under its management, the protocol information for that station is set with respect to said wireless data that has been received, and is transmitted to said station.

[0014]

Furthermore, said access point is connected to a wired communication transmission line and has a function whereby it bridges said wired communication transmission line and said station, and when said access point receives wireless data and the destination of that wireless data is its own access point and said wireless data is connection request data, it determines whether the protocol information set in that connection request data is supported by its access point; when the protocol information is supported, communication is established on the basis thereof and communication operations are performed; when the protocol information is not supported, the protocol information set as the default for that access point is set in the connection reply data and sent back to said station, the station receiving it saves the protocol information provided from said access point, and subsequently when it communicates with said access point, it communicates using this saved protocol information.

[0015]

Thus, with the present invention, when wireless communication between an access point and a station occurs and the station's protocol information is not supported by the access point, the protocol information that has been set as the default is provided to the station and the station communicates with the access point using the provided protocol information.

[0016]

Thus, for example, when several stations exist with respect to an access point and when the various protocols differ, communication which accommodates those differences is possible. With the prior art, a protocol conversion device corresponding to each of the various protocols is necessary, but with the present invention that is unnecessary, so the device scale can be reduced and the cost can be reduced.

[0017]

Furthermore, the access point serves as an access point for said stations and functions as a bridge between said wired communication transmission line and said stations. For a wireless LAN system – that is, when an access point is connected to a wired LAN as a wired communication transmission line, for example and there are stations capable of accessing this access point terminal by means of wireless communication – the present invention enables communication which accommodates protocol differences when communication occurs between the various terminals; therefore, a significant effect can be obtained in that it can be applied to such a wireless LAN system.

[0018]

For example, with this type of system, when the access point receives wired data from the wired LAN as said wired communication transmission line and the destination of that wired data is a given station, that access point determines whether said stations is under its management, and when it determines that said station is under its management, the protocol information for that station is set with respect to said wired data that has been received, and is transmitted to said station.

[0019]

Thus, when the wired data of the station of the given destination that has been transmitted via the access point is transmitted to the station which is the destination of that wired data, communication which accommodates protocol differences can occur.

[0020]

Furthermore, with said system, when said access point receives wireless data and the destination of that wireless data is a given station, that access point determines whether said station is under its management, and if it is under its management, that station's protocol information is set in said received wireless data and is transmitted to said station.

[0021]

Thus, when the wireless data of the station of the given destination that has been transmitted via the access point is transmitted to the station which is the destination of that wireless data, communication which accommodates protocol differences can occur.

[0022]

Furthermore, with said system, when said access point receives wireless data and the destination of that wireless data is its own access point and that wireless data is connection request data and the protocol information set in that connection request data is protocol information that is supported by the access point, communication is established on the basis thereof and communication operations are performed; when the protocol information is not supported, the protocol information set as the default for that access point is returned to the station and the station communicates using that protocol information.

[0023]

Thus, when communication occurs between a station and an access point and the station's protocol information is not supported by the access point, communication is possible by means of the protocol information set as the default at the access point, and communication which accommodates protocol differences can occur.

[0024]

Practical embodiment of the invention

In the following, a practical embodiment of the present invention will be explained. This explanation of a practical embodiment is an explanation of a multiprotocol-compatible communication control method and a multiprotocol-compatible communication system of the present invention, and it includes practical details for a multiprotocol-compatible communication control processing program for a recording medium on which is recorded the multiprotocol-compatible communication control processing program of the present invention.

[0025]

Figure 1 is a schematic system configuration diagram for the purpose of explaining a practical embodiment of the present invention; it has at least one access point (here there are multiple access points, indicated with AP1, AP2, . . .) connected to a wired LAN 1 as a wired communication transmission line, and at least one station (here there are multiple stations, indicated with ST1, ST2, . . .) capable of accessing these access points AP1, AP2, . . . by means of wireless communication.

[0026]

Access points AP1, AP2, . . . serve as access points for stations ST1, ST2, . . . and function as bridges between said wired LAN 1 and stations ST1, ST2, ...

[0027]

Figure 2 shows the respective configurations of access points AP1, AP2, . . . and station terminals ST1, ST2, . . .; here, the configurations of access point AP1 and station ST1 will be explained as representative examples.

[0028]

Access point AP1 has: a wired signal transmitting/receiving unit 11 to enable transmitting/receiving of signals to/from a wired LAN 30; a control unit (CPU) 12 that controls the entire access point AP1; a wireless signal transmitting/receiving unit 13 to enable signal transmission reception with any station; a buffer memory 14 that holds transmitted or received data; a protocol memory 15, which is a nonvolatile memory that stores information for the protocols supported by this access point AP1; a station information database 16 that stores a station list for the purpose of managing logically-connected stations; and a protocol management unit 17 (the processes performed by protocol management unit 17 will be explained hereinafter).

[0029]

Thus, access point AP1 has wired signal transmitting/receiving unit 11 and wireless signal transmitting/receiving unit 13, functioning as a bridge for frames transmitted and received between a wired LAN and a wireless LAN. In addition, wired signal transmitting/receiving unit 11 employs the publicly known CSMA/CD (Carrier Sense Multiple Access with Collision Detection) method, and wireless signal transmitting/receiving unit 13 employs the publicly known CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance) method, for example.

[0030]

In addition, station ST1 has: a wireless signal transmitting/receiving unit 21 to enable the transmitting/receiving of signals to/from any access point; a control unit (CPU) 22 that controls the entire station ST1; a buffer memory 23 that holds transmitted or received data; a protocol memory 24, which is a nonvolatile memory; and a protocol management unit 25. In addition, wireless signal transmitting/receiving unit 21 also employs said CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance) method.

[0031]

Figure 3 shows the configuration of a frame used with the present invention; it comprises a destination address DA, a sender address SA, a control field CF that describes the frame type and the like, a data part DT, and an error check code CRC. There are various frame types – for

example, a connection request frame, a connection reply frame, an ACK frame, and a data frame – in which are set information that indicates the frame type. In addition, data part DT contains the data transmitted at that time and data part DT contains protocol information. In some cases, there is no data.

[0032]

Next, the primary operation of the present invention will be briefly explained. When station ST1 starts up, it searches for an access point; if no access point exists, it enters the idle state. Periodically, a beacon is emitted from an access point, so when this is received it can locate an access point. When it finds an access point (access point AP1), it transmits a connection request frame to the AP1 address which is set in the beacon. Within that connection request frame is set the protocol information required to communicate with access point AP1, and that is transmitted to access point AP1.

[0033]

When a connection request frame from station ST1 is received at access point AP1, the protocol information set within that connection request frame is analyzed by protocol management unit 17, and it determines whether the protocol information is supported by access point AP1. If the protocol information is supported, connection processing proceeds.

[0034]

On the other hand, if the protocol information described in the connection [request] frame from station ST1 is not supported by access point AP1, the protocol information preset as the default in access point AP1 is retrieved from protocol memory 15 and said protocol information is transmitted to station ST1. Consequently, at station ST1, the protocol information that has arrived is stored in protocol memory 24 by protocol management unit 25; subsequently, protocol management unit 25 of station ST1 reads this protocol information stored in protocol memory 24 and said protocol information is used to perform communications.

[0035]

In the following, the overall operation will be explained in detail using the flow charts in Figures 4-7. In the flow charts shown in Figures 4-7, control unit 12 of access point AP1 and control unit 22 of station ST1 perform the primary operations. In addition, when there are multiple stations, the present invention can also perform communication between stations; however, with the present practical embodiment, a case wherein communication occurs between station ST1 and access point AP1 will be explained.

[0036]

In Figure 4, the initial settings for the access point AP1 parameters are made (step s1). As the initial setting, for example, the content of the protocol to be set as the default (the 'default protocol'), the protocol number corresponding thereto, the version, and the like are registered as the default protocol information.

[0037]

The default protocol information settings are provided to the protocol information management unit (step s2), after which a timer is started (step s3). This timer is provided within control unit 12, where it performs a timer operation for the purpose of generating a periodic beacon.

[0038]

Then, a determination is made regarding whether a frame (that is, wired data) from wired LAN 1 has been received (step s4), and when wired data has been received, the processing in Figure 5 ensues. The processing of Figure 5 will be explained later.

[0039]

On the other hand, if it is determined that wired data has not been received, a determination is made regarding whether a frame (that is, wireless data) has been received from a wireless LAN (step s5). If it is determined that wireless data has not been received, a determination is made regarding whether the timer's set value has been reached (step s6); if the set value has not been reached, it returns to step s4, and if the set value has been reached, the timer stops (step s7), a beacon frame is transmitted to wireless signal transmitting/receiving unit 13 (step s8), a beacon is generated, and then it returns to step s4. In summary, the timer operates here to periodically generate a beacon, and if no wired data or wireless data is received after the timer has been set, a beacon is generated after a prescribed time has elapsed from the setting of the timer.

[0040]

In addition, if it is determined in the determination process in said step s4 that wired data has been received, the process in Figure 5 ensues; this will be explained with reference to the flow chart in Figure 5.

[0041]

In Figure 5, first a determination is made regarding whether that wired data destination is the access point itself (step s31); if so, that wired data is transferred to buffer memory 14 (step s32), after which the process moves to step s5 in Figure 4. Furthermore, if the wired data is not of the same destination a determination is made regarding whether it is a broadcast/multibroadcast frame (step s33); if it is a broadcast/multibroadcast frame it is transferred to buffer memory 14 (step s32), after which the process moves to step s5 in Figure 4.

[0042]

Furthermore, if the destination is not the access point itself, and it is not a broadcast/multicast frame, an instruction is sent to protocol management unit 17 to search the station list stored in station information database (hereinafter, 'the database') 16 (step s34).

[0043]

Thus, protocol management unit 17 determines whether a station having the address that is set in the frame of said wired data is on the station list (step s35), and if a station having said address is not on the station list, the received wired data (the frame) is discarded (step s36).

[0044]

Furthermore, if a station having said address is on the station list, the access point sets its own address in the sender address SA that is set in the frame of the wired data that has been received (step s37) and instructs protocol management unit 17 to determine the type of protocol that has been set for communication with that station. Consequently, protocol management unit 17 checks the content of protocol memory 15, extracts the protocol that has been set for said station, and sets it in data part DT (see Figure 3) of the data frame that has been received (step s38).

[0045]

Then, the frame (the received wired data) thus set is transferred to wireless signal transmitting/receiving unit 13 (step s39). Consequently, this frame is emitted from wireless signal transmitting/receiving unit 13. When this step s39 process is performed, the process moves to step s5 in Figure 4.

[0046]

In addition, if it is determined in the determination process in step s5 in Figure 4 that wireless data has been received, a determination is made regarding whether that wireless data

destination is the access point itself (step s9); if so, the process in Figure 6 ensues. The process in Figure 6 will be explained hereinafter. On the other hand, if it is not of the same destination, a determination is made regarding whether it is a broadcast/multibroadcast frame (step s10); if it is a broadcast/multibroadcast frame, it is transferred to buffer memory 14 (step s11), after which the process moves to step s6.

[0047]

Furthermore, if the destination is not the access point itself, and it is not a broadcast/multicast frame, an instruction is sent to protocol management unit 17 to search the station list stored in database 16 (step s12). Consequently, protocol management unit 17 determines whether a station having said address is on the station list (step s13); if a station having the address that is set in the frame of said wireless data, the access point sets its own address in the frame (the sender address SA column shown in Figure 3) of the wireless data that has been received (step s14) and instructs protocol management unit 17 to determine the type of protocol that has been set for communication with that station.

[0048]

Consequently, protocol management unit 17 checks the content of protocol memory 15, extracts the protocol information that has been set for said station, and sets it (step s15).

[0049]

Then, the frame (the received wireless data) thus set is transferred to wireless signal transmitting/receiving unit 13 (step s16). Consequently, this frame is emitted from wireless signal transmitting/receiving unit 13. When this step s16 process is performed, the process moves to step s6.

[0050]

Furthermore, if a station having said address is not on the station list in database 16 (step s13), that frame is transferred to wired signal transmitting/receiving unit 11 (step s17), that data is transmitted to wired LAN 1, and the process moves to step s6.

[0051]

Furthermore, if the destination is not the access point itself and is not a broadcast/multicast frame nor the destination of a station under its management (when it is the destination of a station that is not on the station list stored in its own database 16), it is transmitted to wired signal transmitting/receiving unit 11 and the frame (of the received wireless

data) is transferred to wired LAN 1; this process is performed because wired LAN 1 has a wider band frequency than a wireless LAN and can handle more traffic, thus the data for a station of a destination that is not managed by its access point is transmitted to wired LAN 1.

[0052]

In addition, if it is determined in the process in step s9 in Figure 4 that the destination is the access point itself the process in Figure 6 ensues; that will be explained next.

[0053]

When a frame of its own is received, an ACK frame is transferred to wireless signal transmitting/receiving unit 13 (step s41). Consequently, the ACK frame is transmitted from signal transmitting/receiving unit 13 to the station where the transmission originated.

[0054]

Then, a determination is made regarding the nature of said frame with a destination of the access point itself; here, a determination is made regarding whether it is a connection request frame (step s42); if it is not a connection request frame, it is considered a data frame and is transferred to buffer frame 14 (step s43).

[0055]

On the other hand, if it is a connection request frame, the protocol for the station that produced the connection request (in this case, station ST1) is extracted, the protocol information is transferred to protocol management unit 17, and an instruction is given to search protocol memory 15 to determine whether that protocol information is supported (step s44).

[0056]

Consequently, protocol management unit 17 searches protocol memory 15 to determine if that protocol information exists.

[0057]

Then, a determination is made regarding whether that protocol information is supported (step s45); if it is supported protocol information, a connection reply frame containing no data is created in data part DT (see Figure 3) (step s46), and that is transferred to wireless signal transmission/receiving unit 13 (step s49). Consequently, that connection reply frame is transmitted from wireless signal transmitting/receiving unit 13.

[0058]

On the other hand, if it is determined in said step s45 that it is an unsupported protocol, the default protocol information preset as a default for access point AP1 is read from protocol memory 15 (step s47), a connection reply frame in which that default protocol information is set in data part DT is created (step s48), and is transferred to wireless signal transmitting/receiving unit 13 (step s49). Consequently, that connection reply frame is transmitted from wireless signal transmitting/receiving unit 13.

[0059]

Then, the timer is set (step s50). In this case, the timer is set to await an ACK, so a determination is made regarding whether an ACK from station ST1 is returned within a prescribed period of time (steps s51, s52); if an ACK is returned within the prescribed period of time, an instruction is sent to protocol management unit 17 to make an entry in database 16 (step s53).

[0060]

In other words, at that time, the address, protocol number and version of the station (in this case, station ST1) with which a connection has been established to enable communication are registered in the station list in database 16. Then, the process moves to step s6 in Figure 4. If an ACK is not received within the prescribed period of time, the process returns to step s6.

[0061]

Thus, even if the protocol information for station ST1 is not supported by access point AP1, by means of the heretofore explained processes, the default protocol information set as the default for access point AP1 is provided to station ST1 and the information pertaining to that station is registered in database 16 of access point AP1; subsequently, when communication occurs between station ST1 and access point AP1, the communication occurs based on the default protocol information and the information registered in the station list.

[0062]

Next, the operations at the station (in this case, station ST1) will be explained with reference to the flow chart in Figure 7. The process shown in Figure 7 is performed by control unit 22 of station ST1.

[0063]

First, the initial settings for the parameters are made (step s61), and a determination is made regarding whether a beacon has been received (step s62). When a beacon is received, protocol management unit 25 is queried to determine its own protocol information (step s63), and a connection request frame is set using that protocol information (step s64) and that connection request frame is transferred to wireless signal transmitting/receiving unit 21 (step s65). Consequently, the connection request frame is emitted from wireless signal transmitting/receiving unit 21.

[0064]

Then, the timer is set (step s66). In this case, the timer is set to await an ACK, so a determination is made regarding whether an ACK is returned from access point AP1 within a prescribed period of time (steps s67, s68); if an ACK is not returned within the prescribed period of time, the process returns to step s62 and waits for a beacon.

[0065]

If an ACK is received within the prescribed period of time, the timer is set (step s69). In this case, the timer is set to await a connection reply frame from access point AP1, so a determination is made regarding whether a connection reply is returned from access point AP1 within a prescribed period of time (steps s70, s71), and if a connection reply frame is not received within the prescribed period of time, the process returns to step s61.

[0066]

If a connection reply frame from access point AP1 is received within the prescribed period of time, an ACK frame corresponding thereto is transferred to wireless signal transmitting/receiving unit 21 (step 72). Consequently, an ACK frame is transmitted from wireless signal transmitting/receiving unit 21 to access point AP1. In addition to the transmission of this ACK frame, a determination is made regarding whether protocol information is contained in the connection reply frame received from access point AP1 (step s73).

[0067]

The protocol information that has been set in the connection reply frame is the default information possessed by access point AP1; it is provided to station ST1 from access point AP1 as protocol information which allows communication to occur. In other words, it is provided when the protocol sent from station ST1 is protocol information that is not supported by access

point AP1. Accordingly, future communication will occur by means of the protocol information (default protocol information) set in the connection reply frame.

[0068]

Furthermore, if no protocol information is set in the connection reply frame, it means that the protocol information sent from station ST1 is supported by access point AP1, in which case communication can occur based on that protocol information.

[0069]

In addition, the determination regarding whether protocol information has been set in this connection reply frame is made with the process previously explained with respect to steps s45 through s49 in Figure 6.

[0070]

If no protocol information has been set in the connection reply frame in said step s73, initial settings are performed to allow communication to occur based on its own protocol information, and communication begins (step s76). On the other hand, if it is determined in said step s73 that protocol information is contained in the connection reply frame, an instruction is transmitted to protocol management unit 25 to write that protocol information to the protocol memory (step s74), and that protocol information is written to protocol memory 24 (step s75). Then, the initial settings are made to enable communication with this newly written protocol information, and communication begins (step s76).

[0071]

As explained above, with this practical embodiment, when access point AP1 receives wired data and that wired data destination is not the access point itself, and is not a broadcast/multibroadcast frame, the access point searches the station list stored in its database 16 to determine whether a station having the address in question (the address that is set in the received wired data) exists. If a station having said address exists, [the access point] sets its own address in the sender address SA of the received frame.

[0072]

Furthermore, it determines what protocol has been set for communication with that station, and makes a setting using that protocol. Then, a frame with this setting is transmitted from wireless signal transmitting/receiving unit 13.

[0073]

Thus, when the wired data transmitted from a wired LAN is transmitted from the access point – which functions as a bridge between the wired LAN and a wireless LAN – to a station that is logically connected to this access point, if that station is under the management of that access point, the protocol information corresponding to that station is set in the data of that received frame and communication can occur. Therefore, the wired data can be transmitted to the station even if the protocol for the wired LAN and the protocol for the station differ.

[0074]

Furthermore, when wireless data is received by a given access point and that wireless data destination is not the access point itself, and is not a broadcast/multibroadcast frame, the access point searches its own station list to determine whether a station having the address in question (the address that is set in the received wired data) exists. If a station having said address exists, the access point sets its own address in the sender address SA of the received frame. Furthermore, it determines what protocol has been set for communication with that station, and makes a setting using that protocol. Then, a frame with this setting is transmitted from wireless signal transmitting/receiving unit 13.

[0075]

In this case too, if the station from which this wireless data was transmitted is under the management of said access point, the protocol corresponding to that station is set in said wireless data and communication can occur. Therefore, when wireless communication occurs via an access point, that wireless data can be transmitted to the intended station even if the protocols for communication differ.

[0076]

Furthermore, when a given access point receives wireless data and it is determined that the destination of the wireless data is the access point itself, the access point determines the type of frame of that received data, and when it is a connection request frame, it extracts from that connection request frame the protocol information for the station that transmitted the connection request frame; it then determines whether it supports that protocol information, and if it does support that protocol information, wireless communication based on that protocol information is enabled.

[0077]

On the other hand, if it is determined that said protocol information is unsupported protocol information, the protocol information preset as a default for the access point is read from the protocol memory and set in the data part of a connection reply frame, which is then transmitted to the station. Then, when a connection is established and communication is enabled, the station's address, protocol number, and version are registered in the station list in database 16.

[0078]

Thus, even if the protocol information for a given station is not supported by an access point which is the intended communication party, the protocol information that has been set as the default at that access point is provided to the station; in addition, information pertaining to the station is registered in the station list stored in the access point's database 16. Subsequently, when communication occurs between this station and access point, communication is enabled by means of the default protocol information and the information registered in the station list.

[0079]

It should be noted that the present invention is not limited to the practical embodiment explained above; various modifications are possible without departing from the scope of the invention.

[0080]

Furthermore, the multiprotocol-compatible communication control program of the present invention that performs the processes explained above can be recorded on a recording medium such as a floppy disk, optical disk, or hard disk, and the present invention includes that recording medium. Furthermore, the processing program can be obtained from a network as well.

[0081]

Effect of the invention

As explained above, by means of the present invention, when wireless communication between an access point and a station occurs and the station's protocol information is not supported by the access point, protocol information that has been set as the default is provided to the station and the station communicates with the access point using the provided protocol information; therefore, for example, when several stations exist with respect to an access point and when the various protocols differ, communication which accommodates those differences is possible. With the prior art, protocol conversion devices corresponding to each of the various

protocols is necessary, but with the present invention that is unnecessary, so the device scale can be reduced and the cost can be reduced.

[0082]

Furthermore, the access point serves as an access point for said stations and functions as a bridge between said wired communication transmission line and said stations. For a wireless LAN system – that is, when an access point is connected to a wired LAN as a wired communication transmission line, for example and there are stations capable of accessing this access point terminal by means of wireless communication – the present invention enables communication that accommodates protocol differences when communication occurs between the various terminals; therefore, a significant effect can be obtained in that it can be applied to such a wireless LAN system.

[0083]

For example, with this type of system, when the access point receives wired data from the wired LAN as said wired communication transmission line and the destination of that wired data is a given station, that access point determines whether said stations is under its management, and when it determines that said station is under its management, the protocol information for that station is set with respect to said wired data that has been received, and is transmitted to said station.

[0084]

Thus, when the wired data of the station of the given destination that has been transmitted via the access point is transmitted to the station which is the destination of that wired data, communication which accommodates protocol differences can occur.

[0085]

Furthermore, with said system, when said access point receives wireless data and the destination of that wireless data is a given station, the access point determines whether said station is under its management, and if it is under its management, that station's protocol information is set in said received wireless data and is transmitted to said station.

[0086]

Thus, the wireless data of the station of the given destination that has been transmitted via the access point can be transmitted to the station which is the destination of that wireless data,

and communication which accommodates protocol differences can occur when wireless data is transmitted via the access point.

[0087]

Furthermore, with said system, when said access point receives wireless data and the destination of that wireless data is the access point itself and that wireless data is connection request data and the protocol information set in that connection request data is protocol information that is supported by the access point, communication is established on the basis thereof and communication operations are performed; when the protocol information is not supported, the protocol information set as the default for that access point is returned to the station and the station communicates using that protocol information.

[0088]

Thus, when communication occurs between a station and an access point and the station's protocol information is not supported by the access point, communication is possible by means of the protocol information set as the default at the access point, and communication which accommodates protocol differences can occur.

Brief description of the figures

Figure 1 is a schematic system configuration diagram showing a communication system that employs the present invention.

Figure 2 is a diagram showing the configuration of an access point and a station in Figure 1.

Figure 3 is a diagram showing the structure of a frame used with the practical embodiment of the present invention.

Figure 4 is a flow chart that explains the processing sequence of the practical embodiment of the present invention; it is a flow chart showing a portion of the processing performed by the control unit of an access point.

Figure 5 is a flow chart showing the subsequent processing sequence when it is determined in step s5 of the flow chart in Figure 4 that wired data exists.

Figure 6 is a flow chart showing the subsequent processing sequence when it is determined in step s9 of the flow chart in Figure 4 that the destination is the access point itself.

Figure 7 is a flow chart that explains the processing sequence of the practical embodiment of the present invention; it is a flow chart showing the processing sequence performed by the station's control unit.

Explanation of symbols

1 Wired LAN
11 Wired signal transmitting/receiving unit
12 Control unit
13 Wireless signal transmitting/receiving unit
14 Buffer memory
15 Protocol memory
16 Station information database
21 Wireless signal transmitting/receiving unit
22 Control unit
23 Buffer memory
24 Protocol memory
25 Protocol management unit
AP1, AP2, . . . Access point
ST1, ST2, . . . Station

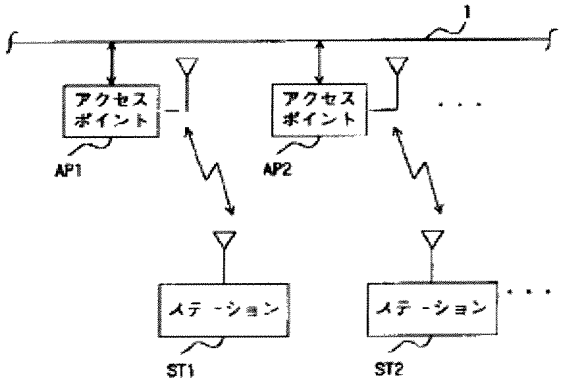


Figure 1

Key: AP1, AP2 Access point
ST1, ST2 Station

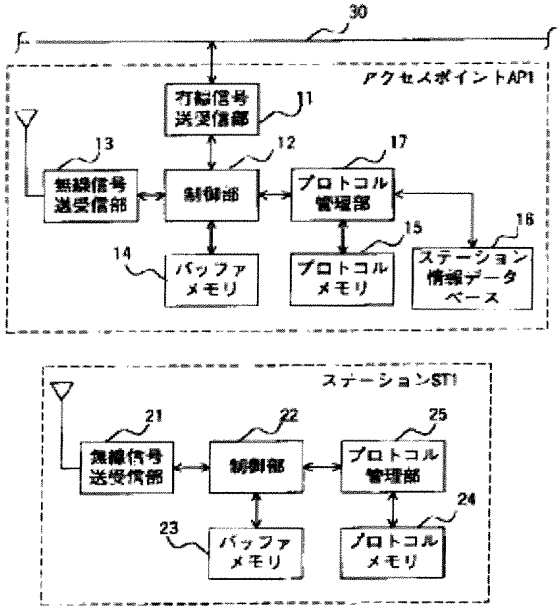


Figure 2

Key:
- 11 Wired signal transmitting/receiving unit
- 12 Control unit
- 13 Wireless signal transmitting/receiving unit
- 14 Buffer memory
- 15 Protocol memory
- 16 Station information database
- 17 Protocol management unit
- 21 Wireless signal transmitting/receiving unit
- 22 Control unit
- 23 Buffer memory
- 24 Protocol memory
- 25 Protocol management unit
- AP1 Access point
- ST1 Station

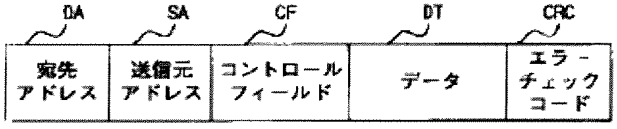


Figure 3

Key:
- DA Destination address
- SA Sender address
- CF Control field
- DT Data

CRC Error check code

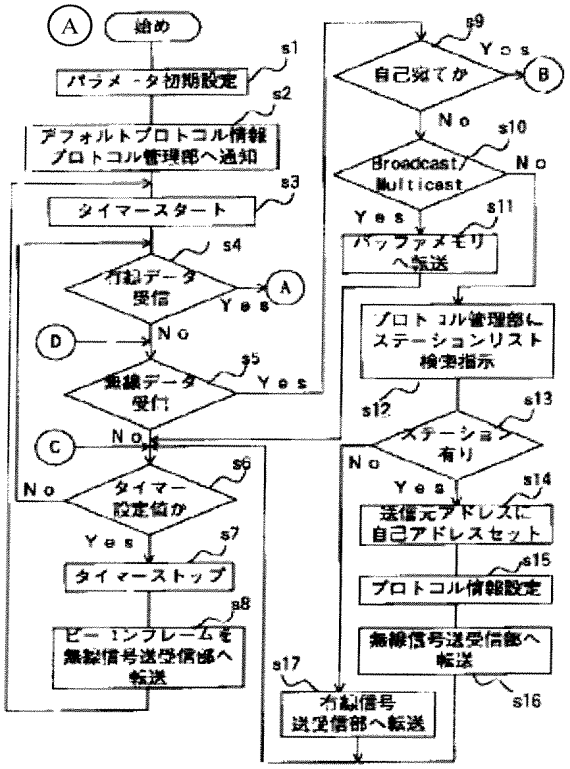


Figure 4

Key:

A	Start
s1	Make initial parameter settings
s2	Transfer default protocol information to protocol management unit
s3	Start timer
s4	Wired data received?
s5	Wireless data received?
s6	Has timer reached set value?
s7	Stop timer
s8	Transmit beacon frame to wireless signal transmitting/receiving unit
s9	Is this access point the destination?
s10	Broadcast/multibroadcast?
s11	Transfer to buffer memory
s12	Instruct protocol management unit to search station list
s13	Does station exist?
s14	Set this address in the sending address
s15	Set protocol information
s16	Transfer to wireless signal transmitting/receiving unit
s17	Transfer to wired signal transmitting/receiving unit

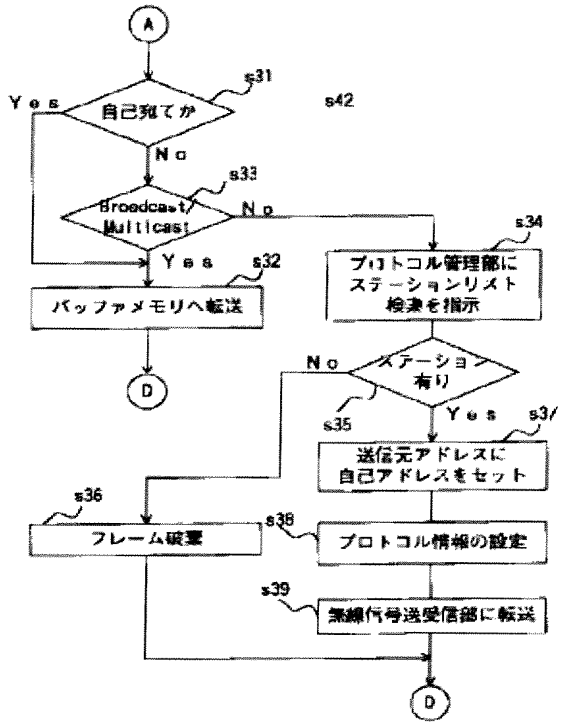


Figure 5

Key:
- s31 Is this access point the destination?
- s32 Transfer to buffer memory
- s33 Broadcast/multibroadcast?
- s34 Instruct protocol management unit to search station list
- s35 Does station exist?
- s36 Discard frame
- s37 Set this address in the sending address
- s38 Set protocol information
- s39 Transfer to wireless signal transmitting/receiving unit

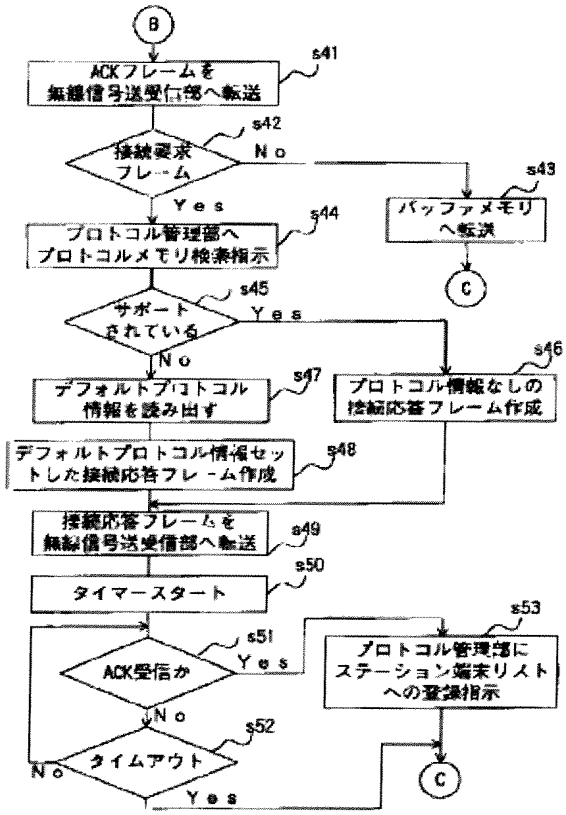


Figure 6

Key:
- s41 Transfer ACK frame to wireless signal transmitting/receiving unit
- s42 Connection request frame?
- s43 Transfer to buffer memory
- s44 Instruct protocol management unit to search station list
- s45 Is it supported?
- s46 Create connection reply frame with no protocol information
- s47 Read default protocol information
- s48 Create connection reply frame with default protocol information
- s49 Transfer connection reply frame to wireless signal transmitting/receiving unit
- s50 Start timer
- s51 ACK received?
- s52 Timeout?
- s53 Instruct protocol management unit to register station in terminal [sic; station] list

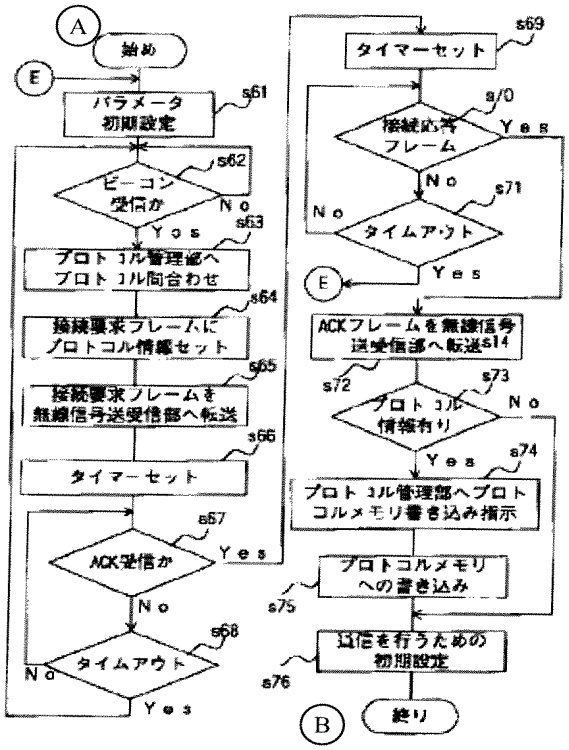


Figure 7

Key:

A	Start
B	End
s61	Make initial parameter settings
s62	Beacon received?
s63	Query protocol management unit regarding protocol
s64	Set protocol information in connection request frame
s65	Transfer connection request frame to wireless signal transmitting/receiving unit
s66	Set timer
s67	ACK received?
s68	Timeout?
s69	Set timer
s70	Connection reply frame?
s71	Timeout?
s72	Transfer ACK frame to wireless signal transmitting/receiving unit
s73	Protocol information exists?
s74	Instruct protocol management unit to write to protocol memory
s75	Write to protocol memory
s76	Make initial settings to perform communication

Continued from front page

F-terms (Reference):

5K033 AA09 CB01 CB02 CB14 CC01 DA03 DA19 DB12 DB18 EC01 EC03
5K034 AA20 DD03 EE03 FF01 FF02 HH06 HH14 HH63 KK21 LL01 NN04
5K067 AA42 DD11 HH22 HH23